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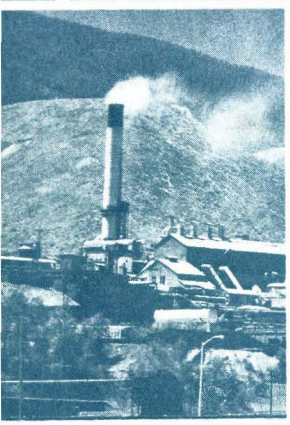

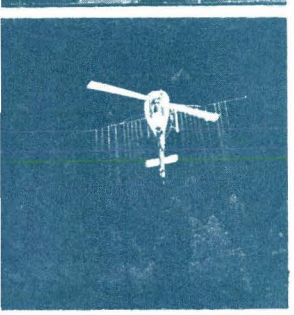

FOREST ENVIRONMENTAL PROTECTION

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LODGEPOLE PINE NEEDLE CAST IN THE LOWER CLARK FORK RIVER DRAINAGE

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ABSTRACT

The pine needle cast fungus, *Lophodermella concolor*, caused severe discoloration and subsequent defoliation of lodgepole pine on over 4,000 acres and light defoliation on over 4,500 acres of lodgepole pine in the lower Clark Fork River drainage in 1975. Some trees had lost the last 3 years' growth of needles, undoubtedly due to *L. concolor* infection in those years. Mortality related to defoliation was not found. Damage occurred over a wide range of habitat types and was most commonly found in pole size stands heavily stocked with lodgepole pine.

INTRODUCTION

Spring discoloration of lodgepole pine (*Pinus contorta* Dougl.) has been increasing for several years in the lower Clark Fork River drainage (Hamel and Dooling, 1975). In the spring of 1975, widespread discoloration was noted by Ranger District personnel.

Microscopic evaluation of needles and pattern of disease development indicated that the causal agent was *Lophodermella concolor* (Dearn.) Darker, a native pine needle cast fungus (Darker, 1932 and 1967).

This paper reports the 1975 distribution and severity of *L. concolor* in the lower Clark Fork River drainage.

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METHODS AND RESULTS

During late June 1975, the lower Clark Fork River and major side drainages were aerially surveyed for lodgepole pine discoloration from a fixed wing aircraft. The survey, beginning at Thompson Falls, Montana, and terminating at Clarkfork, Idaho, involved nearly 65,000 acres. Areas with trees showing discolored crowns were delineated on USFS 2-inch-per-mile cover type maps and intensity of discoloration in each area was rated as severe or light (Figure 1).

Figure 1.--Aerial view of severe (upper arrow) and light (lower arrow) lodgepole pine discoloration caused by *L. concolor*.

Severe discoloration described areas of intense tree discoloration and generally occurred in dense, pole sized, pure lodgepole pine stands, often occurring low in a drainage or on flats on the valley floor. Light discoloration described areas of diffuse or light tree discoloration and generally was found in open, pole sized, stands of mixed species composition, often on ridges or upper slopes.

All easily accessible, aerially mapped areas were ground checked to verify aerial observations.

Identification of causal agent was based on several criteria:

1. Tree-to-tree variation in discoloration severity (Figure 2).

2. Individual needle discoloration initiated at randomly distributed infection points or spots (Figure 3).

3. Involvement of a specific age class of needles (Figure 3).

4. Presence of characteristic sunken, colorless, microscopically visible spore producing bodies (Figure 4).

The above criteria should enable the land manager to distinguish lodgepole pine needle cast from other types of lodgepole pine discoloration, such as winter drying, salt damage, and frost damage, which occur in the spring. Discoloration associated with the latter types of damage begins with the needle tips of youngest needles and, depending upon severity of damage, may progress downward and inward until all needles on a tree or branch are affected.

Figure 2.--Tree-to-tree variation in *L. concolor* needle infection severity.

Figure 3.--*Lophodermella concolor*-caused needle discoloration begins at random points on specific age class of needles.

Figure 4.--Sunken colorless microscopically visible spore-producing bodies of *L. concolor*.

Area location and intensity of tree discoloration in each, as observed from the air, are shown in Figure 5. The largest areas of discolored trees were observed in Tuscor, Martin, and Stevens Creek drainages, and the lower Bull River drainage.

Acreages involved were determined by making dot grid counts on survey maps. Over 4,500 acres were identified with light discoloration, and 4,000 acres with severe discoloration.

Very light discoloration not aerially identified was observed throughout the survey area during ground checking, but because of the low severity and widespread occurrence it was not mapped.

Discoloration was found in habitat types ranging from the *Pseudotsuga menziesii-Physocarpus malvaceus* type through the *Tsuga heterophylla-Pachistima myrsinites* type (Daubenmire and Daubenmire, 1968). Pole sized trees in dense stands undoubtedly resulting from early burns were generally the most seriously affected, particularly if located in low-lying areas.

A wide range in individual tree discoloration, from none to very heavy, was observed in a given damaged stand. Trees had lost from none to 3 years complement of needles, apparently due to infection by *L. concolor* over the previous 3 years. Mortality resulting from continued defoliation was not observed, and most trees were producing abundant normal new growth.

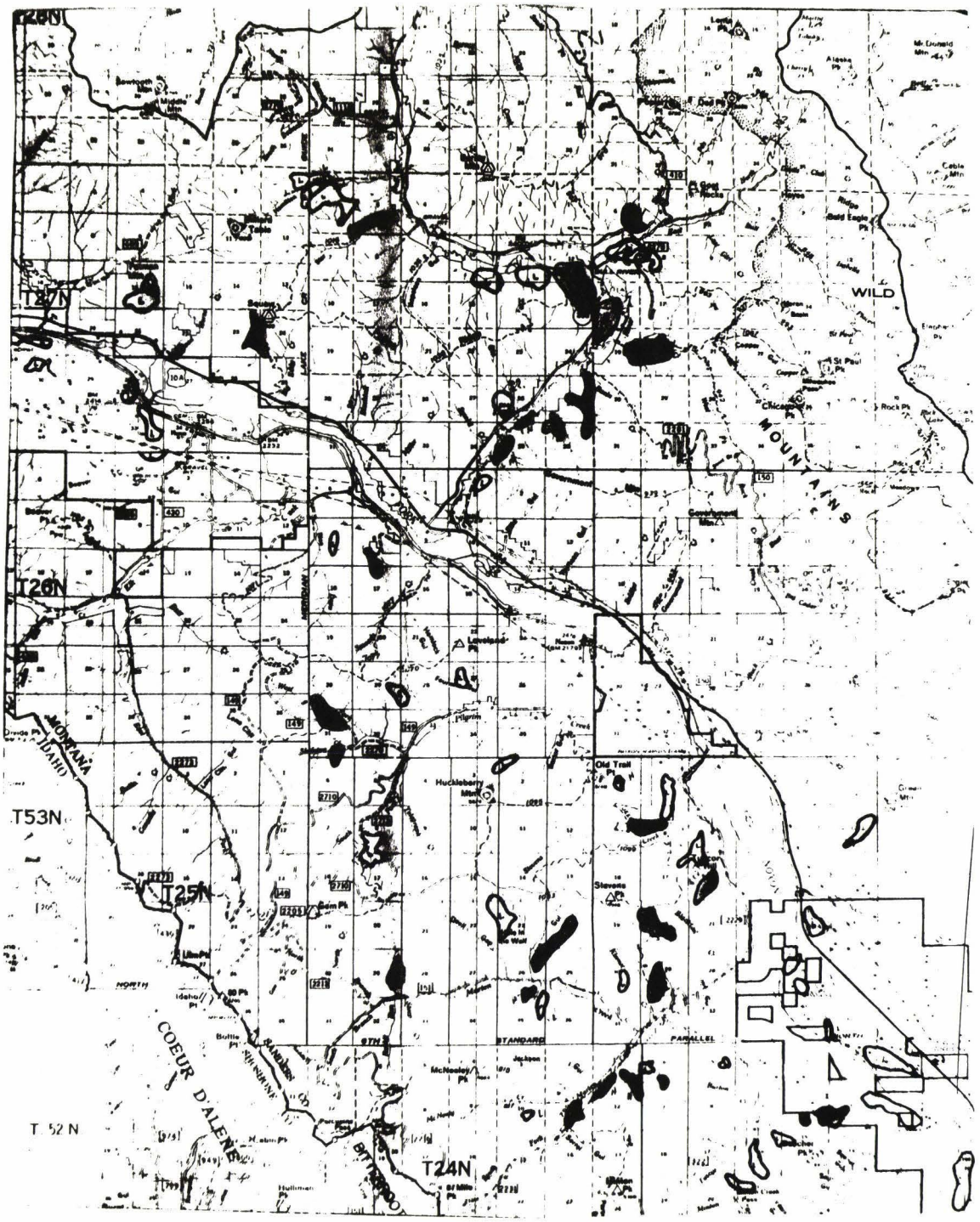

Figure 5.--Main areas of needle cast damage in the lower Clark Fork River drainage in 1975. Darkened areas indicate severe discoloration and involved nearly 4,000 acres. Light areas indicate light discoloration and involved nearly 4,500 acres.

DISCUSSION AND CONCLUSIONS

The disease cycle of *Lophodermella concolor* is relatively simple (Collis, 1972; Darker, 1932). Spores are released from small colorless pustules on previously infected 1-year-old needles in June or July during periods of high humidity. Only young, newly developing needles are infected by the windblown spores. Little external evidence of infection is visible until May or June of the following year, when infected needles turn red-brown, then straw-colored and produce a new crop of spores.

During June and July, the period of sporulation and infection, precipitation averages on the Cabinet Ranger District were 1.42, 1.20, and 1.45 inches for 1973, 1974, and 1975 respectively. The comparatively high precipitation levels for the June-July 1975 period along with the large numbers of discolored needles in 1975 would suggest a good probability that a large amount of needle discoloration will be seen in the spring of 1976.

Defoliation is generally assumed to result in growth reduction and at least in some cases, reduction may be proportional to the degree of defoliation (Church, 1949). But because *L. concolor* affects only one age class of needles (Darker, 1932), and because it is unusual for all foliage to be removed even with continued infection (Boyce, 1961), significant mortality caused by the fungus is not likely to occur. If mortality does occur, it will likely do so in low vigor, or stressed, highly susceptible individuals growing in crowded stands and may involve root pathogens or bark beetles.

Direct control is not practical under forest conditions. However, *Lophodermella concolor* should not pose a serious threat to pine stands derived from local seed sources because of the observed large amount of inherent host tolerance, and because of the critical environmental requirements for infection (Collis, 1972).

Maintenance of mixed, vigorously growing stands will help reduce damage (Collis, 1972).

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